REMARKS

Prior to the present amendment and response, claims 24-26 and 28-48 were pending in the present application. By the present amendment and response, independent claims 24 and 37 have been amended to overcome the Examiner's objections and claims 26, 28-29, and 45 have been canceled. Thus, claims 24-25, 30-44, and 46-48 remain in the present application. Reconsideration and allowance of pending claims 24-25, 30-44, and 46-48 view of the above amendments and the following remarks are requested.

A. Rejection of Claims 24-26 and 28-48 under 35 USC §103(a)

The Examiner has rejected claims 24-26 and 28-48 under 35 USC §103(a) as being anticipated by U.S. patent number 6,013,939 to El-Sharawy et al. (hereinafter "El-Sharawy") in view of U.S. patent number 6,287,932 to Forbes et al. (hereinafter "Forbes") and Figure 1 of the present application. For the reasons discussed below, Applicants respectfully submit that the present invention, as defined by amended independent claims 24 and 37 and independent claim 31, is patentably distinguishable over El-Sharawy, Forbes, and Figure 1 of the present application, singly or in combination thereof.

The present invention, as defined by amended independent claim 24, recites, among other things, a conductor patterned in a second area of a dielectric, where the dielectric is a low-k dielectric and the conductor is selected from the group consisting of copper, aluminum, and copper-aluminum, a permeability conversion material interspersed

within the second area of the dielectric such that the permeability of the second area of the dielectric is higher than the permeability of a first area of the dielectric, where the permeability conversion material is selected from the group consisting of nickel, iron, nickel-iron alloy, and magnetic oxide, and where the permeability conversion material is interspersed in the second area of the dielectric by ion implantation. As disclosed in the present application, in one embodiment of the invention, a first area of a dielectric, such as a low-k dielectric, is covered with a mask while a second area of the dielectric, which includes a patterned conductor, is not covered with the mask.

As disclosed in the present application, by interspersing a permeability conversion material within the unmasked second area of the dielectric, the permeability of the second area of the dielectric is increased while the permeability of the first area of the dielectric remains unchanged. As disclosed in the present application, the permeability conversion material (e.g., nickel, iron, nickel-iron alloy, or magnetic oxide) can be interspersed in the second area of the dielectric by using ion implantation, for example. Thus, by masking a particular area of a dielectric and preventing permeability conversion material from being interspersed in that area, the present invention advantageously achieves control over the particular area (i.e. an unmasked area) of the dielectric in which to intersperse the permeability conversion material.

Thus, for example, by interspersing permeability conversion material in an area of a dielectric that includes an inductor (i.e. a patterned conductor), the present invention can advantageously increase the inductance of the inductor without undesirably increasing the

size of the inductor. Additionally, by controlling the amount of the permeability conversion material that is interspersed in a particular area of a dielectric, the present invention can advantageously control how much the permeability of that area of the dielectric is increased.

In contrast to the present invention as defined by amended independent claims 24, El-Sharawy does not teach, disclose, or suggest a conductor patterned in a second area of a dielectric, where the dielectric is a low-k dielectric and the conductor is selected from the group consisting of copper, aluminum, and copper-aluminum, a permeability conversion material interspersed within the second area of the dielectric such that the permeability of the second area of the dielectric is higher than the permeability of a first area of the dielectric, where the permeability conversion material is selected from the group consisting of nickel, iron, nickel-iron alloy, and magnetic oxide, and where the permeability conversion material is interspersed in the second area of the dielectric by ion implantation. El-Sharawy specifically discloses inductor 20 including center coil region 36, which includes insulative layer 30, magnetic material layer 32, which is situated on insulative layer 30, and insulative layer 34, which is situated in magnetic material layer 32. See, for example, column 1, lines 56-67, column 2, lines 1-36, and Figure 1 of El-Sharawy.

In El-Sharawy, conductive plugs 38 extend through center coil region 36 and electrically contact conductive layer 28 situated below center coil region 36 and conductive layer 40 situated above center coil region 36. See, for example, column 4,

lines 64-67, column 5, lines 1-9, and Figure 1 of El-Sharawy. In El-Sharawy, magnet material layer 32 is formed from a thin film ferromagnetic or ceramic composite magnetic material. See, for example, El-Sharawy, column 4, lines 36-37. However, El-Sharawy fails to teach, disclose, or suggest a permeability conversion material that is selected from the group consisting of nickel, iron, nickel-iron alloy, and magnetic oxide, where the permeability conversion material is interspersed in a second area of a dielectric by ion implantation, as specified in amended independent claim 24.

Additionally, El-Sharawy fails to teach, disclose, or suggest a first area of a dielectric having a first permeability and a second area of the dielectric having a second permeability, where the second permeability is higher that the first permeability, and where the second area of the dielectric is interspersed with a permeability conversion material by ion implantation, as specified by amended independent claim 24. Also, in El-Sharawy, conductive plugs 38, which are formed in vias, comprise tungsten. See, for example, column 4, lines67, and column 5, lines 1-3, and Figure 1 of El-Sharawy. Thus, El-Sharawy fails to teach, disclose, or suggest a conductor patterned in a second area of a dielectric, where the conductor is selected from the group consisting of copper, aluminum, and copper-aluminum, as specified in amended independent claim 24. Thus, the structure (i.e. inductor 20) is substantially different than the structure as specified in amended independent claim 24.

In contrast to the present invention as defined by amended independent claims 24, Forbes does not teach, disclose, or suggest a conductor patterned in a second area of a

dielectric, where the dielectric is a low-k dielectric and the conductor is selected from the group consisting of copper, aluminum, and copper-aluminum, a permeability conversion material interspersed within the second area of the dielectric such that the permeability of the second area of the dielectric is higher than the permeability of a first area of the dielectric, where the permeability conversion material is selected from the group consisting of nickel, iron, nickel-iron alloy, and magnetic oxide, and where the permeability conversion material is interspersed in the second area of the dielectric by ion implantation. Forbes specifically discloses inductor 200 coupled to device 210, where inductor 200 includes inductor pattern 230. See, for example, column 4, lines 17-20 and Figure 2 of Forbes.

However, Forbes fails to teach, disclose, or suggest a permeability conversion material interspersed within a second area of a dielectric such that the permeability of the second area of the dielectric is higher than the permeability of a first area of the dielectric, where the permeability conversion material is selected from the group consisting of nickel, iron, nickel-iron alloy, and magnetic oxide, and where the permeability conversion material is interspersed in the second area of the dielectric by ion implantation, as disclosed in amended independent claim 24. Thus, Forbes fails to cure the basic deficiencies of El-Sharawy discussed above.

On page 3 of the Final Rejection dated June 14, 2005, the Examiner has cited Figure 1 and related text of the present application to teach "a first area of dielectric 102 comprising silicon oxide and having a first permeability, surrounding the inductor."

However, Figure 1 of the present application fails to teach, disclose, or remotely suggest a second area of a dielectric such that the permeability of the second area of the dielectric is higher than the permeability of a first area of the dielectric, where the permeability conversion material is selected from the group consisting of nickel, iron, nickel-iron alloy, and magnetic oxide, and where the permeability conversion material is interspersed in the second area of the dielectric by ion implantation, as disclosed in amended independent claim 24. Thus, the combination of Forbes and Figure 1 of the present application fails to cure the basic deficiencies of El-Sharawy discussed above.

Thus, Applicants respectfully submit that the combination of El-Sharawy, Forbes, and Figure 1 of the present application suggested by the Examiner does not and cannot result in the present invention as specified in amended independent claim 24. Furthermore, Applicants respectfully submit that the combination of teachings proposed by the Examiner simply is not based on sufficient evidence of reason, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to make such modifications. Rather, the reason, suggestion and motivation for the modification proposed by the Examiner is impermissible hindsight reconstruction given the benefit of Applicants' disclosure.

For the foregoing reasons, Applicants respectfully submit that the present invention, as defined by amended independent claim 24, is not taught, disclosed, or suggested by El-Sharawy and Forbes. Thus, amended independent claim 24 is patentably distinguishable over El-Sharawy and Forbes. As such, claims 25 and 30 depending from

amended independent claim 24 are, *a fortiori*, also patentably distinguishable over El-Sharawy and Forbes for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The present invention, as defined by independent claim 31, recites, among other things, an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, where the conductor comprises a plurality of metal turns, and where the plurality of metal turns are not situated underneath the dielectric and not situated above the dielectric. The present invention, as defined by independent claim 31, provides similar advantages as discussed above in relation to the present invention as defined by amended independent claim 24.

In contrast to the present invention as defined by independent claim 31, El-Sharawy does not teach, disclose, or suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, where the conductor comprises a plurality of metal turns, and where the plurality of metal turns are not situated underneath the dielectric and not situated above the dielectric. As discussed above, El-Sharawy specifically discloses magnetic material layer 32, which is formed from a thin film ferromagnetic or ceramic composite magnetic material. However, El-Sharawy fails to

teach, disclose, or remotely suggest a second permeability interspersed within a dielectric, where the permeability conversion material comprises metal ions, as specified by independent claim 31.

Additionally, as discussed above, El-Sharawy discloses conductive plugs 38, which extend through center coil region 36 and electrically contact conductive layer 28 situated below center coil region 36 and conductive layer 40 situated above center coil region 36. However, conductive plugs 38 are not a plurality of metal turns of an inductor, as specified in independent claim 31. Thus, El-Sharawy fails to teach, disclose, or suggest a conductor comprising a plurality of metal turns, where the plurality of metal turns are not situated underneath the dielectric and not situated above the dielectric in which metal ions are interspersed, as specified in independent claim 31.

In contrast to the present invention as defined by independent claim 31, Forbes does not teach, disclose, or suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, where the conductor comprises a plurality of metal turns, and where the plurality of metal turns are not situated underneath the dielectric and not situated above the dielectric. As discussed above, Forbes specifically discloses inductor 200 coupled to device 210, where inductor 200 includes inductor pattern 230. However, Forbes fails to teach, disclose, or remotely suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material

having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, as specified in independent claim 31. Thus, Forbes fails to cure the basic deficiencies of El-Sharawy discussed above.

As discussed above, Figure 1 and related text of the present application merely discloses a first area of dielectric 102 comprising silicon oxide and surrounding an inductor. However, Figure 1 of the present application fails to teach, disclose, or remotely suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, where the conductor comprises a plurality of metal turns, and where the plurality of metal turns are not situated underneath the dielectric and not situated above the dielectric, as specified by independent claim 31.

For the foregoing reasons, Applicants respectfully submit that the present invention, as defined by independent claim 31, is not taught, disclosed, or suggested by El-Sharawy and Forbes. Thus, independent claim 31 is patentably distinguishable over El-Sharawy and Forbes. As such, claims 32-36 depending from independent claim 31 are, *a fortiori*, also patentably distinguishable over El-Sharawy and Forbes for at least the reasons presented above and also for additional limitations contained in each dependent claim.

Independent claim 37 has been amended in include the limitation "wherein said permeability conversion material is interspersed in said second dielectric area of said

dielectric by ion sputtering." The present invention, as defined by amended independent claim 37, provides similar advantages as discussed above in relation to the present invention as defined by amended independent claim 24.

In contrast to the present invention as defined by amended independent claim 37, El-Sharawy and Forbes fail to teach, disclose, or remotely suggest a permeability conversion material that is interspersed in a second dielectric area of a dielectric by ion sputtering, where an inductor is patterned in the second dielectric area. As discussed above, El-Sharawy specifically discloses magnetic material layer 32, which is formed from a thin film ferromagnetic or ceramic composite magnetic material. Also, Forbes specifically discloses magnetic material layer 120, which comprises a high permeability material, such as pure iron or a nickel-iron (NiFe) alloy. See, for example, Forbes, column 3, lines 26-32. Thus, El-Sharawy and Forbes fail to teach, disclose, or remotely suggest a permeability conversion material that is interspersed in a second dielectric area of a dielectric by ion sputtering, where an inductor is patterned in the second dielectric area, as specified by amended independent claim 37.

Moreover, as discussed above, Figure 1 of the present application merely discloses a first area of dielectric 102 comprising silicon oxide and surrounding an inductor. However, Figure 1 of the present application fails to teach, disclose, or remotely suggest a permeability conversion material that is interspersed in a second dielectric area of a dielectric by ion sputtering, where an inductor is patterned in the second dielectric area, as specified by amended independent claim 37.

Thus, Applicants respectfully submit that amended independent claim 37 is also patentably distinguishable over El-Sharawy and Forbes. As such, claims 38-44 and 46-48 depending from amended independent claim 37 are, *a fortiori*, also patentably distinguishable over El-Sharawy and Forbes for at least the reasons presented above and also for additional limitations contained in each dependent claim.

B. Rejection of Claims 31-36 under 35 USC §103(a)

The Examiner has rejected claims 31-36 under 35 USC §103(a) as being unpatentable over Japanese patent number JP 402262308A by Tetsuya Yokogawa (hereinafter "Yokogawa") in view of U.S. patent number 6,069,397 to Cornett et al. (hereinafter "Cornett") and U.S. patent number 5,446,311 to Ewen et al. (hereinafter "Ewen"). For the reasons discussed below, Applicants respectfully submit that the present invention, as defined by amended independent claim 31, is patentably distinguishable over Yokogawa, Cornett, and Ewen, singly or in any combination thereof.

In contrast to the present invention as defined by independent claim 31, Yokogawa does not teach, disclose, or suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, where the conductor comprises a plurality of metal turns, and where the plurality of metal turns are not situated underneath the dielectric and not situated above the dielectric. Yokogawa specifically discloses inductor 2, which includes

spiral type coil 3 sandwiched between insulating layers 4. See, for example, the constitution and Figures 1 and 2 of Yokogawa. Thus, in Yokogawa, spiral type coil 3 is situated between insulating layers 4. In Yokogawa, high permeability magnetic substance 5 is situated above one of insulating layers 4 and high permeability magnetic substance 6 is situated underneath one of insulating layers 4. See, for example, the constitution and Figure 2 of Yokogawa.

In Yokogawa, high permeability magnetic substances 5 and 6 can comprise a cobalt (Co) series amorphous layer and an iron (Fe) system amorphous layer that are laminated. See, for example, the constitution and Figure 2 of Yokogawa. However, Yokogawa fails to teach, disclose, or suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, as specified in independent claim 31.

In contrast to the present invention as defined by independent claim 31, Cornett does not teach, disclose, or suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, where the conductor comprises a plurality of metal turns, and where the plurality of metal turns are not situated underneath the dielectric and not situated above the dielectric. Cornett specifically discloses inductor layer 220 including

patterned conductive trace 110, which is embedded within magnetic material layers 221 and 223. See, for example, column 2, lines 18-21 and Figure 2 of Cornett.

In Cornett, magnetic material layers 221 and 223 can include amorphous copper ferrite ($CuFe_2O_4$) material or amorphous compounds of $BiFeO_3$. See, for example, Cornett, column 2, lines 52-62. However, Cornett fails to teach, disclose, or remotely suggest a permeability conversion material comprising metal ions, as specified in independent claim 31. As is known in the art, metal ions are charged particles. In contrast, discloses using amorphous copper ferrite material, which is electrically non-conductive or insulative. See, for example, Cornett, column 2, lines 55-58. Thus, Cornett fails to cure the basic deficiencies of Yokogawa as discussed above.

In contrast to the present invention as defined by independent claim 31, Ewen does not teach, disclose, or suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion material comprises metal ions, where the conductor comprises a plurality of metal turns, and where the plurality of metal turns are not situated underneath the dielectric and not situated above the dielectric. Ewen is cited by the Examiner to teach a passivation/dielectric layer comprising silicon oxide. However, Ewen fails to teach, disclose, or remotely suggest an inductor comprising a conductor patterned in a dielectric having a first permeability and a permeability conversion material having a second permeability interspersed within the dielectric, where the permeability conversion

material comprises metal ions, as specified in independent claim 31. Thus, Ewen combined with Cornett fails to overcome the deficiencies of Yokogawa as discussed above.

Furthermore, Applicants respectfully submit that the combination of teachings proposed by the Examiner (i.e. Yokogawa, Cornett, and Ewen) simply is not based on sufficient evidence of reason, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to make such modifications. Rather, the reason, suggestion and motivation for the modification proposed by the Examiner is impermissible hindsight reconstruction given the benefit of Applicants' disclosure.

For the foregoing reasons, Applicants respectfully submit that the present invention as defined by independent claim 31 is not suggested, disclosed, or taught by Yokogawa, Cornett, and Ewen, singly, or in any combination thereof. Thus, independent claim 31 is patentably distinguishable over Yokogawa, Cornett, and Ewen. As such, claims 32-36 depending from independent claim 31 are, *a fortiori*, also patentably distinguishable over Yokogawa, Cornett, and Ewen for at least the reasons presented above and also for additional limitations contained in each dependent claim.

C. Conclusion

Based on the foregoing reasons, the present invention, as defined by amended independent claims 24 and 37 and independent claim 31, and claims depending therefrom, is patentably distinguishable over the art cited by the Examiner. Thus, claims

24-25, 30-44, and 46-48 pending in the present application are patentably distinguishable over the art cited by the Examiner. As such, and for all the foregoing reasons, an early allowance of claims 24-25, 30-44, and 46-48 pending in the present application is respectfully requested.

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Respectfully Submitted,
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